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Group: 1765

Sheet 1 of 5

Form 1449*

Filing Date: March 1, 1999

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

Group: 1765

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*Substitute Disclosure Statement Form (PTO-1449)

U.S. PATENT DOCUMENTS

| Examiner Initial | Document Number | Date | Name | Class | Subclass | Filing Date If Appropriate |
|---------------------|----------------------------------|------------|------------------------|--------|----------|-------------------------------|
| | | | | | | |
| | _ 2,842,438 | 07/08/1958 | Saarivirta, et al. | 75 | 135 | 08/02/56 |
| | _ 3,954,570 | 06/04/1976 | Shirk, et al. | 201/ | 15 | 11/11/74 |
| | _ 4,386,116 | 05/31/1983 | Nair, et al. | 427 | 99 | 12/24/81 |
| | _ 4,423,547 | 01/03/1984 | Farrar, P.A., et al. | /29 | 571 | 06/01/81 |
| | _ 4,574,095 | 03/04/1986 | Baum, et al. | 427 | 53.1 | 11/19/84 |
| | _ 4,788,082 | 11/29/1988 | Schmitt | 427 | 248.1 | 12/12/85 |
| | _ 4,931,410 | 06/05/1990 | Tokunaga, et al. | 437 | 189 | 08/25/88 |
| | _ 4,962,058 | 10/09/1990 | Cronin, J.E., et al. | 437 | 187 | 04/14/89 |
| | _ 4,996,584 | 02/26/1991 | Young, P.L., et al. | 357 | 71 | 10/13/88 |
| | _ 5,019,531 | 05/28/1991 | Awaya, N., et al. | 437 | 180 | 05/19/89 |
| | _ 5,100,499 | 03/31/1992 | Douglas, M.A. | 156 | 635 | 06/25/91 |
| | _ 5,158,986 | 10/27/1992 | Cha, et al. | 521 | 82. | 04/05/91 |
| | _ 5,173,442 | 12/22/1992 | Carey, D.H. | 437 | 173 | 03/24/92 |
| | _ 5,240,878 | 08/31/1993 | Fitzsimmons, J.A., et | al437 | 187 | 04/26/91 |
| | 5,256,205 | 10/26/1993 | Schmitt, III, et al. | 118 | 723 | 01/07/92 |
| | _ 5,334,356 | 08/02/1994 | Baldwin, D.F., et al. | 422 | 133 | 08/24/92 |
| | _ 5,354,712 | 10/11/1994 | Ho, Y.Q., et al. | 437 | 195 | 11/12/92 |
| | _ 5,442,237 | 08/15/1995 | Hughes, H.G., et al. | 257 | 759 | 02/04/94 |
| | _ 5,470,789 | 11/28/1995 | Misawa, N. | 437 | 190 | 03/07/95 |
| | _ 5,470,801 | 11/28/1995 | Kapoor, et al. | 437 | 238 | 06/28/93 |
| | _ 5,506,449 | 04/08/1996 | Nakano, et al. | 257 | 758 | 03/23/94 |
| | _ 5,635,253 | 06/03/1997 | Canaperi, et al. | 427 | 437 | 06/07/95 |
| | _ 5,674,787 | 10/07/1997 | Zhao, et al. | 437 | 230 | 01/16/96 |
| | _ 5,679,608 | 10/21/1997 | Cheung, et al. | 437 | 195 | . 06/05/95 |
| | _ 5,681,441 / | 10/28/1997 | Svendsen, et al. | 205 | 114 | 12/22/92 |
| | 5,695,810 | 12/09/1997 | Dubin, et al. | 427 | 96 | 11/20/96 |
| | 5 ,780,358 | 07/14/1998 | Zhou, M.S. | 438 | 645 | 04/08/96 |
| | _ 5,785,570 | 07/28/1998 | Bruni, M.D. | 445 | 52 | 07/25/95 |
| | _ 5,792,522 | 08/11/1998 | Jin, S., et al. | 427 | 575 | 09/18/96 |
| | _ 5,891,804 | 04/06/1999 | Havemann, R.H., et al. | 438 | 674 | 04/14/97 |
| | _ 5,897,370 | 04/00/1999 | Joshi, R.V., et al. | 438 | 632 | |
| | / | | Clampitt, D.A. | 150 | 032 | ∞ 0 <u>8</u> /03/739 |
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Filing Date: March 1, 1999

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U.S. PATENT DOCUMENTS

FOREIGN PATENT DOCUMENTS

| **Examiner Initial | Document Number | Date | Country | Class | Subclass | Translation Yes No |
|-----------------------|--------------------------|---------------------------|---|---------------------------------------|------------|-----------------------|
| **Examiner Initial | | (Inc | OTHER DOCUME | | | |
| | | | ncise Encyclopedia Sons, Inc., New Yor | | / | - |
| | | | k, 8th Edition, Vo Metals, Materials | | | mittee, (eds.), |
| , | Nonferrous | Alloys and | x, Ninth Edition, \ d Pure Metals, ASM Metals Park, OH, 15 | Handbook Commit | ttee, (eds | |
| _ a. | | Copper Film | ub-half Micron Copy ns", VLSI Multileve | | _ | |
| | Photomask, Selectivel | Projecting y Filling l | on of Conductors at g Images into Insul Images with Conduct act, 1 p., (July 1 | ator by Reactivor", <u>Research I</u> | ve Ion Etc | ching, |
| | Circuits", | / | Metallurgy for Wi onal Technology Dis | | | _ |

"Polymide Coatings", In: Packaging, Electronic Materials Handbook, Vol. 1, ASM International Handbook Committee (eds.), ASM

The Agabit Generation and Beyond", VMIC Conference Proceedings,

"Copper Interconnection Deposition Techniques and

Æ., et al., "Ultra Thin Diffusion Barriers for Cu Interconnections at

Integration", 1996 Symposium on VLSI Technology, Digest of Technical Papers,

International, Mater ∤als Park, OH, 767-772, (1989)

Examiner

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(Jyme 18-20, 1996)

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*Substitute Disclosure Statement Form (PTO-1449)

^{**}EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.



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Form 1449*

Atty. Docket No.: 303.557US

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

Applicant: Paul A. Farrar

Filing Date: March 1, 1999

OTHER DOCUMENTS

Initial

(Including Author, Title, Date, Pertinent Pages, Etc.)

| | Ding, et al., "Copper Barrier, Seed Layer and Planerization Technologies", WMIC Conference Proceedings, 87-92, (June 10-12, 1997) |
|--|--|
| | Ernst, et al., "Growth Model for Metal Films on Oxide Surface: Cu on ZnO(0001)-0"", Physical Review B, 47, 13782-13796, (May 15, 1993) |
| | Godbey, D.J., et al., "Copper Diffusion in Organic Polymer Resists and Inter-level Dielectrics", <u>Thin Solid Films, 308-309</u> , 470-474, (1997) |
| | Hirao, S., et al., "A Novel Copper Reflow Process Using Dual Wetting Layers", 1997 Symposium on VLSI Technology, Digest of Technical Papers, 57-58, (1997) |
| | Iijima, T., et al., "Microstructure and Electrical Properties of Amorphous W-Si-N Barrier Layer for Cu Interconnections", <u>1996 VMIC Conference</u> , 168-173, (June 18-20, 1996) |
| | Izaki, M., et al., "Characterization of Transparent Zinc Oxide Films Prepared by Electrochemical Reaction", Journal of the Electrochemical Society, 144, 1949-1952, (June 1997) |
| | Jayaraj, K., et al., "Low Dielectric Constant Microcellular Foams", Proceedings from the Seventh Meeting of the DuPont Symposium on Polymides in Microelectrics, Wilmington, DE, 474-501, (Sep. 16-18, 1996) |
| | Jin, C., et al., "Porous Xerogel Films as Ultra-low Permittivity Dielectrics for ULSI Interconnect Applications", Advanced Metallization and Interconnect Systems for ULSI Applications, Boston, MA, 463-469, (October 1996) |
| | Kang, H.K., et al., "Grain Structure and Electromigration Properties of CVD CU Metallization", <u>Proceedings of the 10th International VLSI Multilevel Interconnection Conference</u> , 223-229, (June 8-9, 1993) |
| td | Laursen, T., et al., "Encapsulation of Copper by Nitridation of Cu-Ti Alloy/Bilayer Structures", <u>International Conference on Metallurgical Coatings and Thin Films</u> , Abstract No. H1.03, San Diego, CA, pg. 309, (April 1997) |
| Markey | Miller, R.D., et al., "Low Dielectric Constant Polyimides and Polyimide Nanofoams", <u>Seventh Meeting of the DuPont Symposium on Polymides in</u> <u>Microelectronics</u> , 443-473, (September 1996) |
| and the state of t | Miyake, T., et al., "Atomic Hydrogen Enhanced Reflow of Copper", Applied Physics Letters, 70, 1239-1241, (1997) |
| Examiner | Data Considered C |
| | Bernard Sour Date Considered 9/18/00 |
| *Substitute Disc | Rosure Statement Form (PTO-1449) |

**EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.



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Serial No. 09/259,849

Applicant: Paul A. Farrar

Filing Date: March 1, 1999

Group: 1765

OTHER DOCUMENTS

**Examiner (Including Author, Title, Date, Pertinent Pages, Etc.) Initial Murarka, S.P., et al., "Copper Interconnection Schemes: Elimination of The Need of Diffusion Barrier/Adhesion Promoter by the Use of Corrosion Resistant, Low Resistivity Doped Copper", SPIE, 2335, 80-90, (October 20-21, 1994) "Refractory Metal Engapsulation in Copper Wiring", Palleau, J., et al., Materials Research Society Symposium Progeedings, 337, pp. 225 - 231, (April 1994) "Activation Engrgy for Electromigration in Cu Films", Park, C.W., et al., <u>Applied Physics Letters, 59(</u>, 175/-177, (July 6, 1991) "Nanoporous Silica for Dielectric Constant Less Than 2", Ramos, T., et al., Advanced Metalization and Interconnect Systems for ULSI Applications, Boston, (October 1996) Rossnagel, S.M., "Magnet fon Sputter Deposition of Interconnect Applications", Conference Proceedings, ULSI XI, 227-232, (1996) "Wigh Conductivity Copper Rich Cu-Zr Alloys", Transactions Saarivirta, M.J., of the Metallurgical Society of AIME, 218, 431-437, "100 nm Wide Copper Lines Made by Selective Electroless Deposition", Journal of Micromechanics and Microengineering, 1, 66-72, (March 1991) Srivatsa, A/R., et al., "Jet Vapor Deposition: an Alternative to Electrodeposition", Surface Engineering, 11, 75-77, "Electromigration Characteristics of Copper Interconnects", et al., IEEE Electron Devices Letters, 14, 249-251, (May 1993) "Methods and Needs for Low K Material Research", Materials Research Society Symposium Proceedings, Volume 381, Low-Dielectric Constant Materials -- Synthesis and Applications in Microelectronics, Lu, T.M., et al., (eds.), San Francisco, CA, 3-17, (April 17-19, 1995) Van Vlack, L.H., Elements of Materials Science, Addison-Wesley Publishing Co., Inc. Reading, MA, p. 468, (1959) "Highly Reliable Silicon Nitride Thin Films Made by Jet Wang, X.W., et al., Vapor Deposition", <u>Japanese Journal of Applied Physics, 34</u>, 955-958, (February 1995) Examiner Date Considered

**EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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| **Examiner Initial | OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.) | |
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| | | RECI HAY - |
| | Wolf, S., et al., Silicon Processing for the VLSI Era, Vo Technology, Lattice Press, Sunset Beach, CA, p. 514-538, | |
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U.S. PATENT DOCUMENTS

| *Examiner Initial | Document Number | Date | Name | Class | Subclass | Filing Date If Appropriate |
|----------------------|-----------------|------------|---------------------------------------|-------|----------|-------------------------------|
| • | | | | | | |
| BES | _ 5,243,222 | 09/07/1993 | Harper, J.M., et al. | 257 | 774 | 01/08/92 |
| 1565 | _ 5,426,330 | 06/20/1995 | | 257 | 752 | -109/21/93 |
| BE3 | _ 5,739,579 | 04/14/1998 | Chiang, C., et al. | 257 | 635 | O 09/10/96 |
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U.S. PATENT DOCUMENTS

| *Examiner Initial Document N | umber | Date | Name | Class | Subclass | Filing Date If Appropriate |
|------------------------------|-------|------------|------------------------|-------|----------|-------------------------------|
| BES 5.538. | | 05/02/1006 | | 425 | 105 | 01/05/05 |
| 7.45 | | 07/23/1996 | Cooper, K.J., et al. | 437 | 195 | 01/25/95 |
| BES 5,972, | 804 | 10/26/1999 | Tobin, P.J., et al. | 438 | 786 | 11/03/97 |
| <u> </u> | 117 | 12/28/1999 | Hong, Q., et al. | 438 | 629 | 03/19/97 |
| <u>RES</u> 6,030, | 877 | 02/29/2000 | Lee, C., et al. | 438 | 381 | 10/06/97 |
| <u> </u> | 077 | | • | 430 | 301 | 10,00, |
| **Kraminer | | FO | REIGN PATENT DOCUMENTS | | | Translation |

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